CLASSIFICATION CONFIDENTIAL

CENTRAL INTELLIGENCE AGENCY
INFORMATION FROM
FOREIGN DOCUMENTS OR RADIO BROADCASTS
CONFIDENTIAL

REPORT
CD NO.

50X1-HUM

COUNTRY USSR

DATE OF INFORMATION 1947

SUBJECT Economic - Chemical industry

HOW PUBLISHED Monthly periodical

DATE DIST. 15 March 1949

WHERE PUBLISHED Moscow

NO. OF PAGES 9

DATE PUBLISHED November 1947

SUPPLEMENT TO REPORT NO.

LANGUAGE Russian

THIS IS UNEVALUATED INFORMATION

SOURCE Khimicheskaya Promyshlennost', No 11, 1947. (FDB Per Abs 34T48--Translation specifically requested.)

DEVELOPMENT OF AGRICULTURAL INSECTICIDE INDUSTRY IN PAST THIRTY YEARS

V.I. Orlov, Cand Tech Sci
K. A. Gar, Cand Agr Sci
M. G. Gabriyelova, Cand Tech Sci

The manufacture of insecticides is one of the youngest branches of the Soviet chemical industry, a brain child of the Five-Year Plans.

The annual losses due to insect pests in prerevolutionary Russia with its backward agriculture have been estimated at 2,430,000,000 rubles, inclusive of fields, orchards, market gardens, forests, livestock, etc. This sum is on a par with the annual budget for all Russia at that time. (A. G. Labedev "Losses Due to Harmful Insects in the United States and in Russia," Kiev, 1919.) In spite of this, there was practically no domestic production of preparations and appliances for the control of crop pests and diseases.

There was no arsenic industry in Tsarist Russia, deposits of this metal notwithstanding. The whole national demand for arsenic and arsenical preparations was met by imports. For example, the totals received from abroad were 2,800 tons in 1911, 1,012 tons in 1913 and 5,095 tons in 1914. ("Agricultural Entomology," edited by Prof V. N. Shchegolev, OGIZ, Sel'khogiz, 1941.) The position was similar with regard to other preparations used at that time for control of crop pests and diseases, blue vitriol, green vitriol, barium chloride and others.

After the Revolution, a radical change in harvest protection took place, in particular, the development of the chemical method for control of crop pests and diseases. The Soviet government regards this as one of the most important state measures for increasing agricultural productivity and lowering harvest loss, the ultimate object being growth of the national income and a rise of the workers' standard of living. The socialist system of husbandry, made possible by the Revolution, greatly facilitated the

CLASSIFICATION CONFIDENTIAL

STATE	X NAVY	X NSRB	DISTRIBUTION
ARMY	X AIR	X FBI	

organization of the control of plant pests and diseases. In 1918, the Department of Plant Protection (OZR) of the People's Commissariat of Agriculture RSFSR was organized.

However, intervention and civil war prevented the development of a system of control measures at that time. Moreover, the existence of enormous tracts of abandoned land created extremely favorable conditions for mass multiplication of many aggressive pests, locusts, winter borers, etc. According to far from complete data, about one million hectares of seeds were injured or destroyed by locusts and 2,172,000 hectares of winter wheat by borers between 1921 and 1926. The situation required speedy action, and in 1925 the first air antilocust chemical expeditions were organized and the Scientific Research Laboratory of Poisonous Substances was set up within the People's Commissariat of Agriculture (Narkomzem). The work of this laboratory laid the foundation of thorough scientific insecticide investigations in the USSR. In the same year the government issued a number of decrees on plant quarantine with the object of preventing the entry of dangerous pests into the Soviet Union and the dissemination of pests from infected parts of the country.

In the major party and governmental decrees concerning the several phases of the agricultural life of our land--the harvesting and processing of agricultural products, improvement and extension of the various branches, planting of valuable crops--much attention has been and is being devoted to control of pests and diseases.

Naturally, during the early postrevolutionary era the chemical industry was unable to satisfy the increasing demand for agricultural insecticides. Even at the beginning of the First Five-Year Plan, such important inorganic preparations as arsenic, fluorine and silicofluorine salts and dry fungicides were not manufactured in the country, not to mention insecticides of organic origin. Barium chloride and green vitriol were produced in small quantities.

The turning point in the expansion of the insecticide industry came in 1931, when the industrial production of Paris green, sodium arsenite and AB fungicide was organized. The last-named product has been successfully employed up to the present time, not only on ordinary, but also on vernalized grain seeds.

If Paris green and sodium arsenite are among the most widely known of stomach insecticides, then the AB preparation, suggested by Prof A. I. Borgardt and produced at home, is to a certain extent peculiar to the Soviet Union range of fungicides. Elaboration of production technique, establishment of the optimum copper content, ascertaining the effect of the chemical composition of the preparation on its toxicity for rust spores and on the germination of grain crops, all this preceded its manufacture and introduction into operational practice.

The problem of further extending insecticide and fungicide production in turn demanded increased research in this field. With this in view, a special Scientific Research Institute of Insecticides and Fungicides was established within the framework of the chemical industry in May 1931. It incorporated the existing groups of workers from the Institute of Applied Mineralogy and the Moscow division of VIZRA (All-Union Institute for Protection of Plants). The new institute was the focal point of basic scientific research in the chemistry and technology of agricultural insecticides and the study of their insecticidal, fungicidal, chemical and physical properties. The interests of the project called for merging this institute with the NIU (Scientific Institute of Fertilizers.) The NIUIF (Scientific Institute of Fertilizers, Insecticides and Fungicides) had a special insecticide and fungicide department in 1933.

By the end of the First Five-Year Plan the foundations of the insecticide chemical industry had been laid and by 1932 the Soviet Union was able to meet completely the demand for preparations for control of crop pests and diseases.

In the Second Five-Year Plan the increase in insecticide production was almost entirely in the field of inorganic compounds. Production of barium chloride, green vitriol, sodium silicofluoride, sodium fluoride, Paris green, sodium arsenite, powdered and lump sulfur, AB and various preparations was increased. The industry mastered the production of calcium arsenate, a valuable stomach preparation from scorodite ores. In 1936-37 production of calcium arsenite and "Protars" began; the latter is widely used as an antirust fungicide for grain crops. As a result, the output of the chief agricultural insecticides and fungicides was five to six times greater in 1937 than it was in the last year of the First Five-Year Plan.

The Third Five-Year Plan, which has passed into the history of our country as the chemistry Five-Year Plan, opened up still greater prospects to the insecticide industry.

The general growth of the chemical industry enabled numerous organic compounds to be used for the needs of agriculture. These included formalin, chloropicrin, cyanide flux, sodium cyanide, carbon bisulfide, dichlorethane, paradichlorbenzene, naphthaline, benzene polychlorides, betanaphthene, etc. Prescriptions and manufacture of new preparations, such as mineral oil emulsion concentrates, with and without toxic additives, caterpillar glue and others, and the range and production of inorganic insecticides and fungicides were worked out.

Before 1939, arsenic-bearing oxide ores (scorodites) were used directly for the preparation of insecticides to economize on white arsenic. Efforts were made to introduce diluted preparations into agricultural practice, in particular, diluted calcium arsenite and a number of arsenic-saving preparations, such as magnesium arsenite.

The creations of a domestic arsenic industry in the Third Five-Year Plan again raised the question of arsenical preparations and agriculture began to receive full-strength preparations of calcium arsenate, calcium arsenite, etc. In the same Five-Year Plan the technical problems of producing preparations of three important insecticide plants, pyrethrum, anabasis and tobacco, were solved.

The considerable increase in pyrethrum acreage and the necessity of finding a method of turning pyrethrum flowers into stable, effective and easily-applied preparations stimulated extensive research in this field, crowned by the discovery of the "hot" method of preparing extracts of pyrethrum and other pyrethrine insecticides, using dichlorethane as a solvent and employing the standard equipment of oil extraction, essential oil, and bone plants.

The high insecticidal properties of anabasis were first discovered by Prof A. P. Orekhov in 1929. He introduced it into general practice as being one of the best contact poisons, equal to nicotine in effectiveness. Its recognition led to research on improving the technique of producing anabasine sulfate by the dichlorethane method; in conjunction with complex treatment of this valuable insecticidal plant and simultaneous production of oxalic acid and potash.

At the beginning of World War II the Soviet Union had a range of insecticide and fungicides which numbered up to 50 chemical substances for control of crop pests and diseases, wood and storehouse pests.

malaria mosquito grubs, and finally, dwelling parasites. This range satisfied the main agricultural requirement regarding harvest defense. As a result, one of the most dangerous and aggressive pests, the locust, was completely exterminated in our country before World War II. Infection of grain crops by borers was reduced to a minimum and control of garden beet weevils, meadow moths and other pests and crop diseases was proceeding with great success.

All these measures were carried out, using our own poison chemicals, produced in new plants, built during the Five-Year Plans, in accordance with technological plans and methods devised in the USSR by Soviet scientists and engineers.

When looking back on the development of the production and use of poison chemicals for control of crop pests and diseases, special mention must be made of the great amount of scientific research work carried out at this time, which blazed the trail of insecticide and fungicide production, both concerning questions of technology and those connected with the agricultural use of poison chemicals.

The experimental work during this period was primarily aimed at producing a range of insecticides and fungicides suitable for the conditions of the Soviet Union and assisting the chemical industry to master the production of poison chemicals and also the solving of problems of a theoretical nature: the establishment of the connection between the toxicity of certain classes of organic compounds and their structure, physical and chemical investigation of individual organic compounds, devising of objective methods of evaluating the physical properties of insecticides, the study of the atomization and resistance of insecticides, the mechanism of the action of certain stomach insecticides, the production of activating additives to increase the toxicity of the basic preparation, investigation of the p eability of the cuticles of insects to certain organic compounds, penetration of chemical compounds through seed tissues, toxicity, stability and chemical properties of various forms of the active principle of the pyrethrum plant, pyrethrine.

Besides work on inorganic insecticides and fungicides, scientific researchers have paid great attention to the study of the insecticidal and fungicidal properties of synthetic organic compounds. The insecticidal properties of a large number of plant species of the USSR flora have also been investigated.

Many products, belonging to various classes of organic compounds, have been synthesized and studied in order to discover new contact poisons of organic origin, new fumigants, fungicides, green plant fungicides and antiseptics for nonmetallic materials.

The employment of organic products already produced by the chemical industry as insecticides and fungicides involved studying polymerization and depolymerization of formalin, the evaluation of the fumigation and toxic properties of chloropicrin, dichlorethane, ethylene oxide and cyanide flux for storehouse pests, and the limits of inflammability of carbon bisulfide, dichlorethane and ethylene oxide vapors.

Scientific work on the technology and chemistry of poison chemicals was mainly carried out in the Department of Insecticides and Fungicides of NIUIF by a team of researchers: K. Ye. Bezzub, Yu. N. Bezobrazov, S. F. Bezuglyy, Ye. P. Belokrinitskiy, L. M. Borisova, L G. Vol'fson, M. G. Gabriyelova, K. A. Gar, A. S. Deshevaya, M. F. Zubov, E. E. Ivanovskiy, M. Ye. Kuperman, N. N. Mel'nikov, A. V. Molchanov, M. A. Morozova, V. I Orlov, Ye. A. Pokrovskiy, P. V. Popov, S. Ye. Raskin, I. S. Rozenkrants, A. A. Rusakova, Ye. I. Sventsitskiy, A. I Strel'tsova, Ye. M. Toropova, N. I.

Trushkina, N. A. Fuks, S. M. Shogam, and partly by I. V. Golitsyn in one of the laboratories subsequently incorporated into GIGKhS (State Scientific Research Institute of Mineral and Chemical Raw Materials), and in the many factory laboratories which have furnished suggestions for improving the quality and perfecting the technology of poison chemicals.

The following took part in this work in factories and factory laboratories: N. S. Artamonov, N. I.Afanas'yev, V. N. Volkov, V. F. Vol'nov, Ya. S. Dimitrenko, V. A. Dzis'ko, G. M. Strongin, F. I. Senchuk, Ye. G. Pastukhov, A. V. Pospelov, G. N. Khalatov, V. F. Churilkina, Ya. S. Dimitriyenko. Problems of the chemistry and technology of insecticides and fungicides have attracted the attention of the greatest scientists, Academicians E. V. Britske, A. N. Nesmeyanov, S. I. Vol'fkovich and Corresponding Member of the Academy of Sciences USSR A. D. Petrov, who have done much valuable research and made many useful suggestions.

Much work was done on insecticides and fungicides by a group of chemists and toxicologists who used to work in the laboratories of the Insecticide and Fungicide Department of the NIUIF: S. P. Berdennikova, A. P. Vasil'yevskiy, L. S. Golynker, B. B. Girshgorn, M. I. Il'inskaya, E. I. Kan, F. V. Koblova, N.I. Lebedeva, I. S. Levitan, M.S. Limonik, L. G. Makarova, V. A. Mikhalev, E. M. Mikhel'son, S. M. Mashtakov, M. S. Perevezentseva, I. A. Pleteneva, I. N. Pomerantsev, A. S. Rezakova, M. S. Rokitskaya, M. T. Serebrennikova, K. I. Strochitskiy, N. I. Spitsyn, N. D. Sigrianskaya, A. G. Sokolov, A. V. Sokolova, V. Ye. Trupp, R. Kh. Freydlina, K. A. Chasovnikova and others. Not a little of the testing of new preparations was done in NIUIF, the All-Union Institute of Plant Protection, and in certain branch agricultural institutes and experimental stations of the Soviet Union.

The general growth and technical equipment of the chemical industry in course of time allowed a number of chemical and technological questions to be raised again and new, more complete solutions found for certain problems.

We shall give some examples of the technological progress and development of insecticide and fungicide production.

In the early stages of the work of creating an insecticide and fungicide industry, the question of economizing in certain substances, in short supply at that time, was of great importance. Besides white arsenic, of which mention has already been made, circumstances required the strictest economy in the use of copper, mercury, caustic soda and many products of organic origin. This resulted in research on utilizing industrial waste products for producing poison chemicals and on inventing substitutes for certain universally known insecticides, Paris green and Bordeaux mixture.

For example, work on finding substitutes for Paris green led to the production of a number of preparations with a reduced content of the active principle, As_2O_3 and CuO, which decreased the expenditure of certain products.

Among the most successful preparations of this series were a Paris green with a lowered arsenic and copper content, and "Arsenit," copper arsenite diluted with a filler. The latter was intended to replace Paris green for control of the larvae of the malaria mosquito. Two preparations were proposed as substitutes for Bordeaux mixture: copper salts of sulfo acids of raw anthracene and copper salts of the sulfo acids of naphthol tar, the use of which resulted in a considerable saving of copper, as compared with Bordeaux mixture.

However, in most cases work on the utilization of waste products did not produce positive results, as their composition varies, their toxic content is small, and turning them into high quality products often costs more than working from the usual raw material.

In course of time the raison d'etre of such work and preparations disappeared and the possibility of turning out concentrated, highly effective preparations increased more and more.

This enabled the chemical industry, even during World War II, to master the production of a new preparation for control of malaria mosquito larvae, thiodiphenylamine, distinguished from arsenical preparations by its relative harmlessness for men, animals, water fowl and fish. It is now widely used as a larvicide by public health employees.

When production of insecticides and fungicides in the USSR was first organized, one of the chief stomach insecticides, calcium arsenate, was made from oxidized arsenical ores (scorodites) in view of the shortage of white arsenic.

The next step was in 1935 when the method of producing calcium arsenate on an industrial scale by oxidizing white arsenic with bleaching powder was mastered. The product contained a considerable admixture of chlorides. At the same time, research was being carried out on the so-called thermal method of preparing calcium arsenate, whereby calcium arsenite paste, obtained by the action of lime on white arsenic in an aqueous medium, is heated to 600-650 degrees and oxidized by atmospheric oxygen. This simple method, which does not involve the use of caustic soda and other materials in short supply, proved unsuitable as the calcium arsenate thus prepared was several times less toxic than the product obtained under other conditions.

In 1937 the industry began to employ a new method of producing calcium arsenate worked out in the USSR, whereby this product is obtained from solutions of sodium arsenate and lime. The sodium arsenate solution is prepared by oxidizing a sodium arsenite solution by air in the presence of blue vitriol, which acts as a catalyst. This method, while ensuring the production of a high-quality product, involves a comparatively high expenditure of caustic soda.

Finally, a new and better method has recently been devised, whereby calcium arsenate is prepared from arsenic acid, produced by oxidizing white arsenic with nitric acid. The essential advantage of this method is that no caustic soda is required and considerably less bulky apparatus, which offers exceptionally favorable prospects for its use. Moreover, assimilation of the production of arsenic acid revealed prospects of obtaining, not only calcium arsenate, but also other arsenic acid salts, such as copper arsenate, barium arsenate, etc.

Research on the physical and chemical qualities of insecticides and fungicides allowed a new approach to the fixing of standards and technical specifications for poison chemicals, which disclosed many reserves and internal possibilities in industry as regards raising their quality. A good example of this is sodium silicofluoride which is extensively used, mainly for control of the beet weevil. The industrial product had poor dispersion properties and a tendency to coke; consequently, its effectiveness was small and it could not be applied by dusting. Investigations showed that by charging the precipitation conditions a substantial improvement in dispersion properties could easily be effected, and the hygroscopicity could be lowered by washing out water-soluble impurities, thereby improving pulverization. The latter can also be improved by the introduction of 10-20 percent of filler, such as marl, diatomite, silica gel.

Any enterprise can familiarize itself with these changes in technology and one plant has already manufactured an experimental batch of the improved product this year.

The "colloidal sulfur" preparation produced this year is another example of the utilization of internal reserves on a scientific basis by the chemical industry. It has long been known that the effectiveness of sulfur preparations is proportional to their dispersion. A study of the plant-burning properties of water-soluble impurities in the sulfur paste manufactured when freeing coke and generator gas of hydrogen sulfide, and the alteration in its surface properties produced by treating it with sulfite pulp extracts enabled this product to be used as a highly effective insecticide.

The preparation "hexachlorane," a talc-like hexachlorcyclohexane dust, is also the result of considerable scientific research activity. The technology of hexachlorcyclohexane production, worked out by Soviet scientists and engineers and based on the photochemical chlorination of benzene, enabled the manufacture of this product, which is exceptionally effective for the most diverse insect species, to be rapidly organized.

The production of the mercury organic seed fungicide NIUIF-2, vital to agriculture, was preceded by a thorough and exhaustive study of the properties of mercury organic compounds, which facilitated the discovery of the most active mercury compounds, whose use as the toxic principle of fungicides led to a 16.5-1.5 percent drop in the mercury content of the preparations. This considerably increased the economic value of mercury organic fungicides and satisfied a prerequisite for organizing the manufacture of NIUIF-2 preparation in the USSR. Many years of research on testing the new fungicide, carried out by dozens of agricultural scientific research organizations showed that this preparation is effective, not only against borers, but also against helminthosporiosis and fuzariosis of grain crops, and also against the diseases of flax seeds, oil crops, flower crops and tau-sagyz.

There is no doubt that another mercury organic fungicide, NIUIF-1, for moist seed spraying, will be soon included in the range of poison chemicals used in the USSR. Producing it as a powder preparation mixed with a soluble filler obviates its sole defect, difficulty of transportation. The excellent antiseptic properties of the active principle of this preparation, ethylmercurphosphate, were successfully utilized even during World War II for preserving special timber and other materials from rotting.

In the arsenal of scientific institutes and laboratories there is a large number of prescriptions and technological production schemes for new and effective poison chemicals. Among these are caterpillar glues, concentrates of mineral oil emulsions with toxic additives, new seed fungicides, new fungicides for green plants, new organic stomach and contact preparations and, finally, selective herbicides.

During World War II the production of poison chemicals was sharply curtailed since many plants were in the occupied zone and were evacuated or destroyed and others were shut down or changed over to other products.

However, even during those terrible years, problems of the chemical method of plant protection were not forgotten. In December 1944 on the initiative of the People's Commissariat of the Chemical Industry USSR and the NIUIF a scientific and technical conference on problems of the chemistry, technology and application of insecticides was held. About 60 scientific research institutions, higher educational institutions and plants took part in the conferences, as also did representatives of the People's Commissar of Agriculture USSR, the People's Commissar of Public Health USSR, and other organizations and People's Commissariats.

The conference discussed the main problems which had recently arisen for the chemical industry and agriculture in connection with the necessity of extending control of crop pests and diseases by all available means. The conference was of great importance for the development of creative work on insecticides and fungicides, the attacking of essential problems on which scientific research thought should concentrate and for attracting attention to questions pertaining to the chemical method of plant protection.

During the 2 years which have elapsed since World War II the chemical industry has had well-defined success in resuming the production of poison chemicals.

The tasks of the chemical industry now comprise not only a sharp rise in the production of the existing preparations, but a rapid and determined assimilation of new products, so as to satisfy fully agricultural requirements for effective poison chemicals for the control of crop pests, diseases and weeds and the defense of livestock.

The February plenum of the Central Committee of the Communist Party in its resolution "Measures for Improving Agriculture in the Postwar Period," gave the chemical industry a vital task ".....to reach the planned output of poison chemicals by the end of 1947."

The task of increasing decisively the yield of agricultural crops cannot be fulfilled without the extensive introduction of the chemical method of control of crop pests and diseases into agricultural practice.

The Stalin plan for the reconstruction and recovery of the national economy, by examining the recovery and development of poison chemical production, provides a basis for the development of the chemical defense of the harvest on a new technical foundation.

New, highly effective organic preparations; the application of poison chemicals as concentrated solutions, suspensions and emulsions; the use of insecticides as aerosols; the replacement of low-power preparations by high power, such are the lines along which the production and application of insecticides and fungicides has already begun to develop.

The 1947 jubilee is a landmark in the development of the chemical method of plant defense in the Soviet Union.

This year the chemical industry, using the latest achievements of science in the field of insecticides and fungicides, has mastered the production of five high-power preparations for control of agricultural crop pests and diseases and made them available to agriculture: hexachlorocyclohexane, dichlordiphenyltrichlorethane, the mercury organic fungicide NIUIF-2, zinc phosphide and the "colloidal sulfur" preparation. The range of insecticides and fungicides created in the Soviet Union as a result of many years of scientific and practical work on the chemical method of plant protection and including up to fifty preparations, has been supplemented by two new organic universal insecticides, GKhTsG and DDT, by the mercury organic fungicide for seed and technical crops, the preparation of NIUIF-2, by a preparation for control of mouse-type rodents and spermophiles, zinc phosphide, and by a highly effective fungicide for green plants, which also has an acaricidal action, the "colloidal sulfur" preparation.

Out of the five preparations named, three are organic compounds. This is no mere coincidence. On the one hand, it reflects the general tendency to increase the role and importance of organic synthesis in the field of preparations for control of crop pests and diseases. On the other hand, it bears witness to the great possibilities for our chemical industry,

which has already succeeded in mastering the production of new and complex organic preparations during the second year of the Five-Year Plan.

The first steps taken by the chemical industry in the postwar period show how great are its opportunities and potentialities. They must be used more boldly and more extensively; scientific achievements must be introduced more rapidly; and then the national economy will assuredly receive the necessary range and quantity of poison chemicals.

Not only agriculture, but also forestry, public health and building undertakings stand in need of means to control pests and fungi. It is the task of the chemical industry to satisfy the poison chemical requirements not of agriculture alone, but of all branches of the national economy.

- E N D -